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Canadian Science Advisory Secretariat
Science Response 2015/003

Maritimes Region

WESTERN COMPONENT (4XOPQRS5) POLLOCK HARVEST CONTROL RULE UPDATE REPORT

Context

Pollock in NAFO Areas 4VWX5 comprise two population components: a slower-growing Eastern Component including Divisions 4V and 4W, as well as Unit Areas 4Xm and 4Xn, and a faster-growing Western Component (WC) including 4Xopqrs and Canadian portions of Area 5. The WC has been the main focus of past analytical assessments, but scientific advice on stock status and catch limits using Virtual Population Analysis (VPA) modeling has been highly variable, especially since the mid-2000s. For example, the 2008 assessment indicated that age 4+ population biomass was at 27,000 metric tonnes (mt) (Stone et al. 2009), while the 2010 assessment update indicated 4+ population biomass was either 23,000 mt or 17,000 mt, depending on whether the very low 2010 Fisheries and Oceans Canada (DFO) Research Vessel (RV) survey indices were excluded or included from the analysis (Stone 2011). Consequently, the Canadian fishing industry recommended exploration of alternative approaches that would provide more stability in future catch limits to allow for better business planning and a more stable fishery.

In 2011, fisheries managers and the fishing industry decided to manage WC Pollock using a risk-management approach and embarked on a Management Strategy Evaluation (MSE) process, with the help of government scientists and outside experts (DFO 2011). MSE is a technique to explicitly consider the uncertainty in stock assessment assumptions and models, and to compare the likely consequences to Management Objectives when a predetermined Management Procedure (MP) incorporating a Harvest Control Rule (HCR) is applied. The Pollock MP was selected on the basis of satisfying three medium-term objectives agreed upon for management of the resource which relate to sustainability, catch levels and the extent of annual catch changes. The MP model was built around an HCR, which either increased or decreased future catch limits based on results from ongoing monitoring from the annual DFO summer RV survey. An Exceptional Circumstances Protocol was put in place to cover situations that fall outside the range for which the MP was simulation tested and, if necessary, to allow for some form of intervention.

Recently, DFO Fisheries and Aquaculture Management posed the following question to DFO Science: What is the Western Component catch level for fishing year (FY) 2015-2016 generated by the Harvest Control Rule described in SAR 2011/054 "*Western Component Pollock Management Strategy Evaluation*"? This report provides an update to the 2013 report (DFO 2014) on the Western Component Pollock Harvest Control Rule and provides advice on the FY 2015-2016 catch limit generated by the Pollock MP and HCR using updated information from the 2014 summer RV survey. It also describes current status with respect to the provisions in the Exceptional Circumstances Protocol. The HCR with updated monitoring data for 2014 generated a catch limit of 2,781 mt for FY 2015-2016, down 9% from 3,072 mt for FY 2014-2015. The RV survey biomass index decreased from 28.45 kg/tow in 2013 to 8.53 kg/tow in 2014, but this decline did not trigger the exceptional circumstance provision of the RV survey biomass index being < 6 kg/tow for two consecutive years and the Survey Index Ratio being < 0.2.

This Science Response Report results from the Science Response Process of December 4, 2014, on the Western Component Pollock Harvest Control Rule 2014 Stock Status Update.

Analysis and Response

DFO Summer Survey Index

The DFO Summer survey time series for the WC Pollock biomass index measured in kilograms per tow (kg/tow) extends from 1984-2014, a period when the same survey vessel (*CCGS Alfred Needler*) and bottom trawl (Western IIA) have been used annually (Figure 1). The index is based on survey strata representing unit areas 4Xopqrs+5Yb and does not include 5Zc (eastern Georges Bank). The biomass index exhibits strong year-effects that reflect the semi-pelagic schooling behavior of Pollock and changes in availability arising from differing distributions in the water column at the times of the survey. In general, there has been a declining trend in the index since the late 1980s, an increasing trend from 2003-2007, followed by another decline to 2012. While the index increased in 2013, it declined again in 2014. Although the index is highly variable, the long term trends are important. The RV series using a 3-year geometric mean (GM) (three-year moving average) provides a better impression of long term trends by removing year effects and provides the monitoring data used in the HCR for calculating future catch limits (Figure 1).

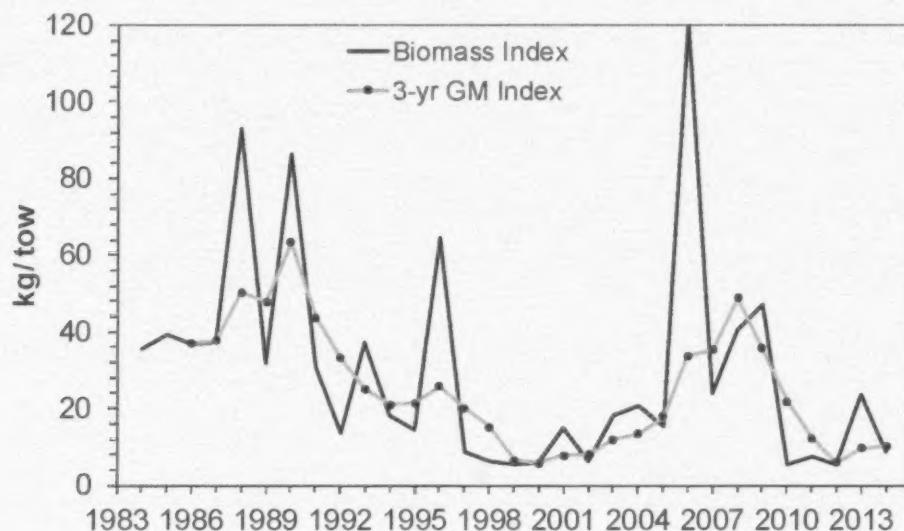


Figure 1. DFO Summer RV survey biomass index and 3-year geometric mean (GM) index based on survey strata representing unit areas 4Xopqrs+5Yb, 1984-2014.

Harvest Control Rule

The Pollock MP is linked to the HCR to calculate catch limits based on results from ongoing monitoring (Summer RV Survey). The catch limit either increases or decreases by up to 20% (with increases capped at 500 mt) depending on the value of the GM biomass index for the most recent 3 years (i.e. 2012-2014) as a proportion of the GM of the index for 1984-1994; a period of high productivity (also referred to as the Survey Index Ratio). The catch limit was initially set at 6,000 t in 2011 for the Pollock MP model. The survey biomass index increased from 5.28 kg/tow in 2012 to 23.45 kg/tow in 2013 then decreased to 8.53 kg/tow in 2014;

however, because the index was very low in 2012 (5.28 kg/tow), the 3-year GM value for 2012-2014 shows only a modest increase to 10.81 kg/tow and the resultant Survey Index Ratio is now at 0.28. Even though the 2012-2014 GM value was slightly higher than last year's value (9.6 kg/tow), the HCR calculates a catch limit of 2,781 mt for FY 2015/2016, down 9% from the 3,072 mt catch limit calculated for FY 2014/2015. This lag effect is due to the tuning parameters that are incorporated into the HCR formula for computing the TAC each year (Rademeyer and Butterworth 2011). In order for the FY 2015/2016 catch limit to have increased, the summer survey biomass index for WC Pollock in 2014 would have had to exceed 10 kg/tow.

Exceptional Circumstances Protocol

There are provisions to cover situations outside the range for which the Pollock MP model was simulation tested (or correspondingly beyond situations that the management procedure was designed to handle). These provisions can be applied by decision-makers to amend the catch limits set by the Pollock MP or to revise the MP itself but should not be a frequent occurrence. They are based on unexpected results (up or down) from monitoring data (i.e. RV survey biomass index).

Results that would trigger an exceptional circumstance based on the protocol established in DFO 2011 include:

1. When the Survey Index Ratio falls below 0.2 or is beyond the 90% probability level from model predictions.

The current Survey Index Ratio (based on the 3-year GM survey index for 2012-2014 as a proportion of the index for 1984-1994) is 0.28 which is above the exceptional circumstance value of 0.2.

2. When the RV survey biomass index is < 6.0 kg/tow for two consecutive years.

The RV index was 8.53 kg/tow in 2014, 23.45 kg/tow in 2013 and 5.28 kg/tow in 2012, which does not trigger an exceptional circumstance.

3. Additional situations.

RV survey age-specific indices are monitored for changes in age structure which could also trigger an exceptional circumstance (i.e. when extremely compressed/expanded). There has been a period of diminished numbers at age for older ages from 1995-2005, with some modest improvement since then (Figure 2). While the recent age structure indicates that there are few fish in the population older than age 7, there was a notable increase in the abundance at age for all ages in 2013, compared to the previous three years, followed by a decline in abundance for most ages in 2014. While these changes do not trigger an exceptional circumstance, they do suggest that stock rebuilding may not be progressing to the extent indicated from last year's survey.

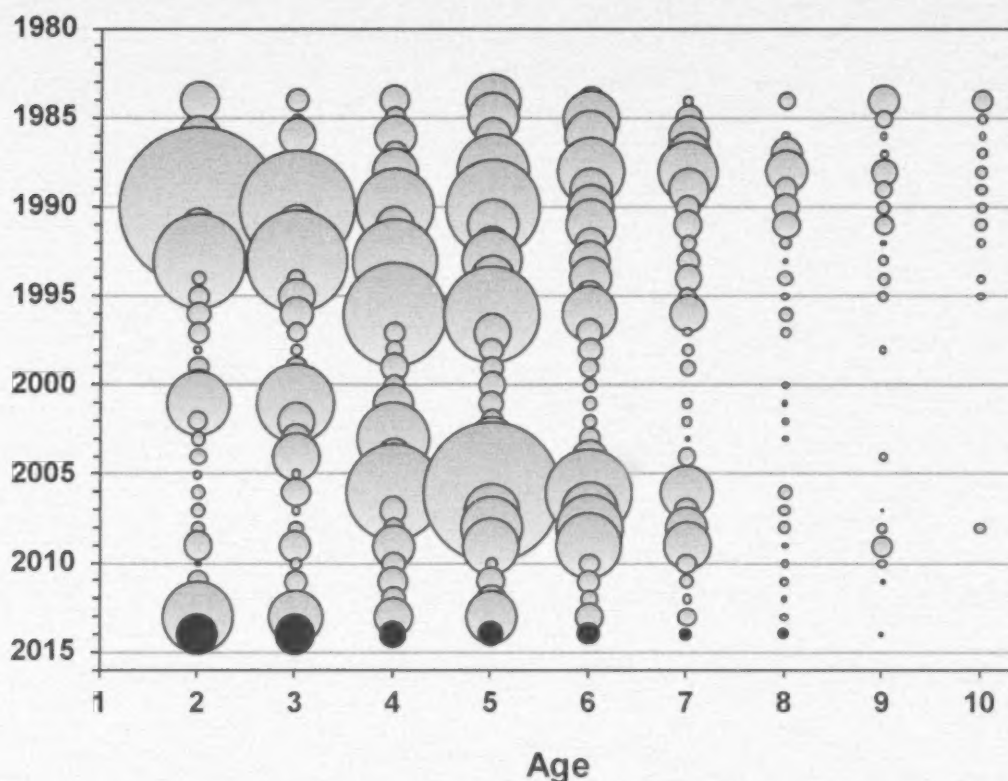


Figure 2. Stratified mean number per tow at age for Pollock from the DFO summer RV survey based on strata representing unit areas $4Xopqrs+5Yb$ for ages 2-10, 1984-2014. The index values for the 2014 survey are shown in black (Bubble size is proportional to the stratified mean number per tow at age).

Conclusions

Using updated monitoring data, the HCR calculates a catch limit of 2,781 mt for WC Pollock for FY 2015-2016. If the DFO summer RV survey biomass index for WC Pollock is greater than 5.5 kg/tow in 2015, then the catch limit will start to increase again. Although this update is not entirely positive, the exceptional circumstance provision has been avoided and so there is no need to review the MP model at this time.

The Pollock MP and its HCR have responded to declining trends in the survey biomass index for WC Pollock by bringing the catch limits down over the past few years. Unless an Exceptional Circumstance is triggered, application of the MP will provide the catch limit for WC Pollock until 2016, after which there will be a thorough review, including a re-evaluation of the Reference Set of Operating Models to ensure they reflect current stock dynamics. At this time, Fisheries and Aquaculture Management, Industry and Science can address other issues such as additional biomass growth and further recovery. Management Objectives will also be reviewed, in particular the trade-offs between catch and sustainability.

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Sources of Information

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